Space Weather Technical Forecast

Issued on Tuesday 22 October 2024 at 13:09 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Early Chance of G1/Minor Geomagnetic Storms. Increasing chance of Radio Blackouts this week.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity observed at GOES16 and 18 was Low - confined to C-class flares with a very smooth X-ray trace that mainly comprised of small magnitude long-period east limb activity from high in the corona.

There are nine numbered sunspot regions on the visible disc. AR3859 in the southwest, has shown areal decay in the peripheral spots surrounding the main leader. AR3863 in the southeast saw minor simplification and decay in it's trailing portion. All other spots are small or simple.

A filament eruption was observed in centre disk around 22/0500UTC but no CME has yet been identified. No other Earth-directed CMEs were in evidence in the period.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by ACE at L1, were indicative of a slow regime. The solar wind speed declined from 350 km/s to around 310 km/s. The solar wind density was around average or below. The IMF was at Background levels at or below 8nT, but with a rising trend after 22/0330UTC, with the north-south component ranging between +5 and -7nT. The phi angle was negative (towards the Sun) until 22/0330UTC before becoming positive (Away from the Sun) thereafter. The net result of the above solar wind measures was Quiet to Unsettled (Kp 0-2).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at Background levels. High energy electron flux (greater than 2MeV) observed by GOES16 was mainly at Normal Background levels, but with a Moderate peak of 316pfu at 21/1705UTC. The associated 24-hour fluence was well below the Active threshold. The 22/0000UTC observation was 6.24e6 integrated pfu on a slight upward trend.

Four-Day Space Weather Forecast Summary

Solar Activity: Activity is Likely to be Low, with a Chance of Moderate activity from isolated M-class flares initially. Activity is then likely to increase through the period, with the return of several notable active regions over the eastern limb: probably becoming Moderate from midweek UTC.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs in the forecast. A fast wind regime may become established from CH82/+ within the current UTC day, with a Chance of peak Minor geomagnetic storm (G1) conditions, before activity declines to Quiet to Unsettled levels after midweek UTC.

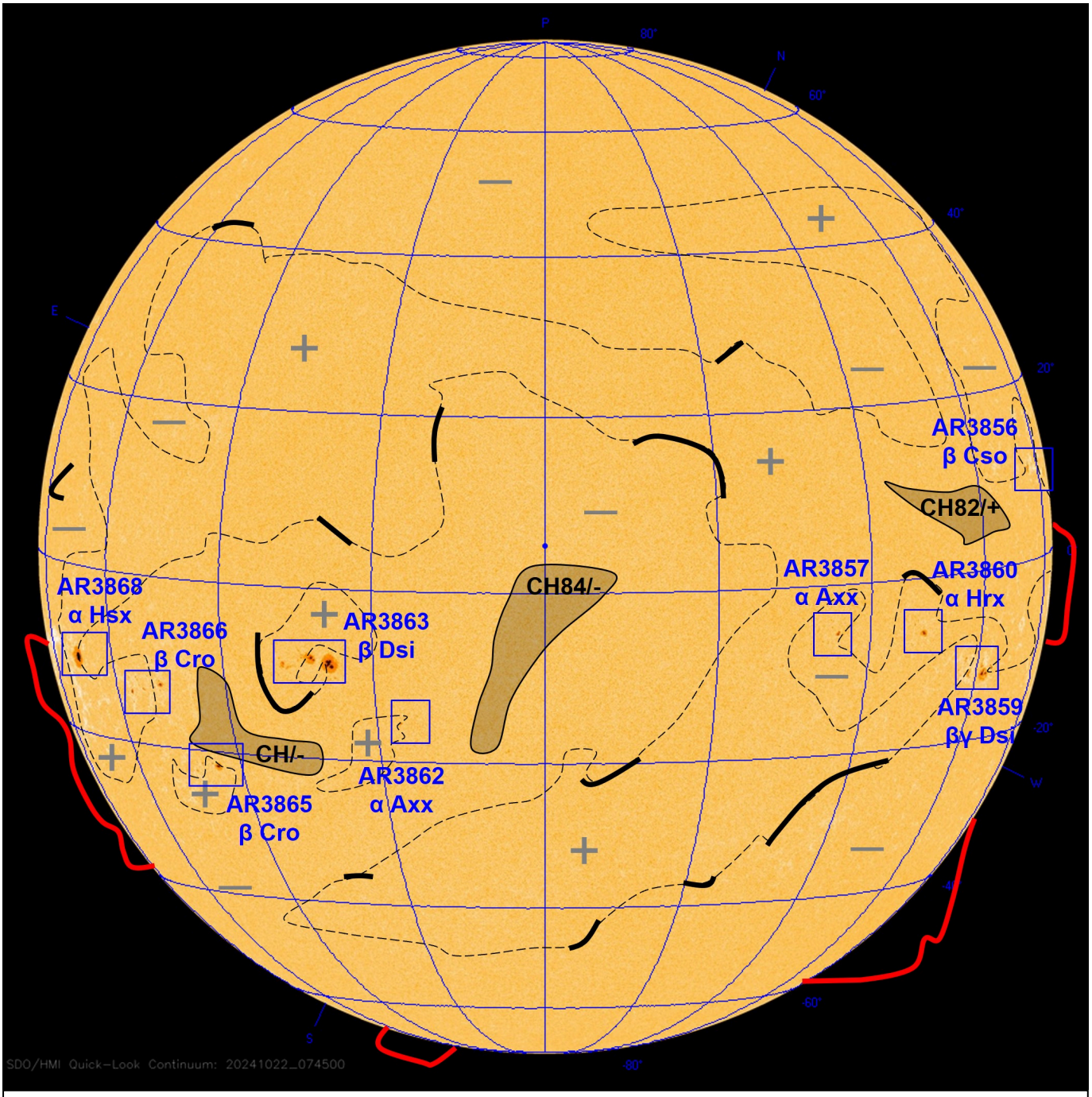
Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is Expected to remain at Background levels.

High energy electron flux at GOES16 is forecast to remain mainly Background to Moderate levels with the associated 24-hour fluence Expected to remain below Active (1e8 total pfu) throughout.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 1: Solar synoptic map valid 22/0745 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms

No Earth-directed CMEs feature in the forecast.

Solar winds are now at Background levels. The next enhancement is likely to be from the onset of fast winds from CH82/+. This is a recurrent, but smaller feature compared to the previous rotation, but due to its more equatorial location has a high likelihood of connection to Earth. The anticipated arrival for any CIR region is expected within the current UTC day (Tuesday 22 October). A period of Slightly Elevated to Elevated solar winds is then expected to follow. Given that peak G1 Minor Storm intervals were observed on the previous rotation associated with this enhancement, similar is possible on this occasion. MOSWOC Enlil model output does show a weak enhancement possibly associated with this feature, however this is later (in model space) than currently anticipated given the coronal hole's location, and not considered as good guidance.

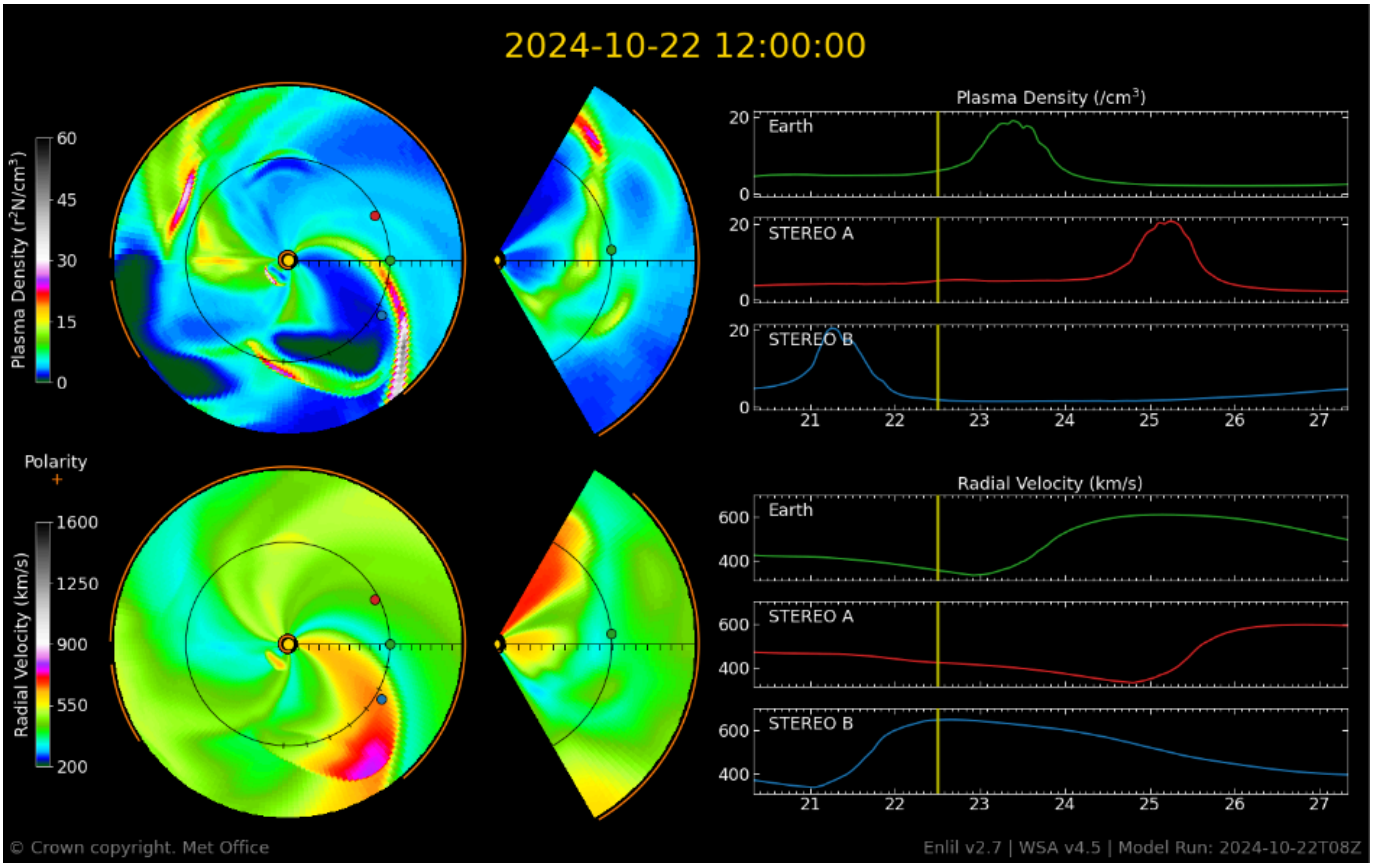
Geomagnetic activity is forecast to be Quiet to Unsettled initially. Fast wind onset from CH82/+ is then expected to bring Active to G1 Minor Storm intervals on Tuesday 22 October. Activity is expected to decline to Quiet to Unsettled levels after midweek UTC.

Geomagnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	40	25	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 2: MOSWOC Enlil



© Crown Copyright 2024. All Rights Reserved.

Radio Blackouts - X-Ray Flares

The current disc, while reasonable well-populated in terms of the number of sunspot regions, bears few regions on significance, with very limited C-class activity well-spread and in fact mainly arising from the oncoming eastern limb.

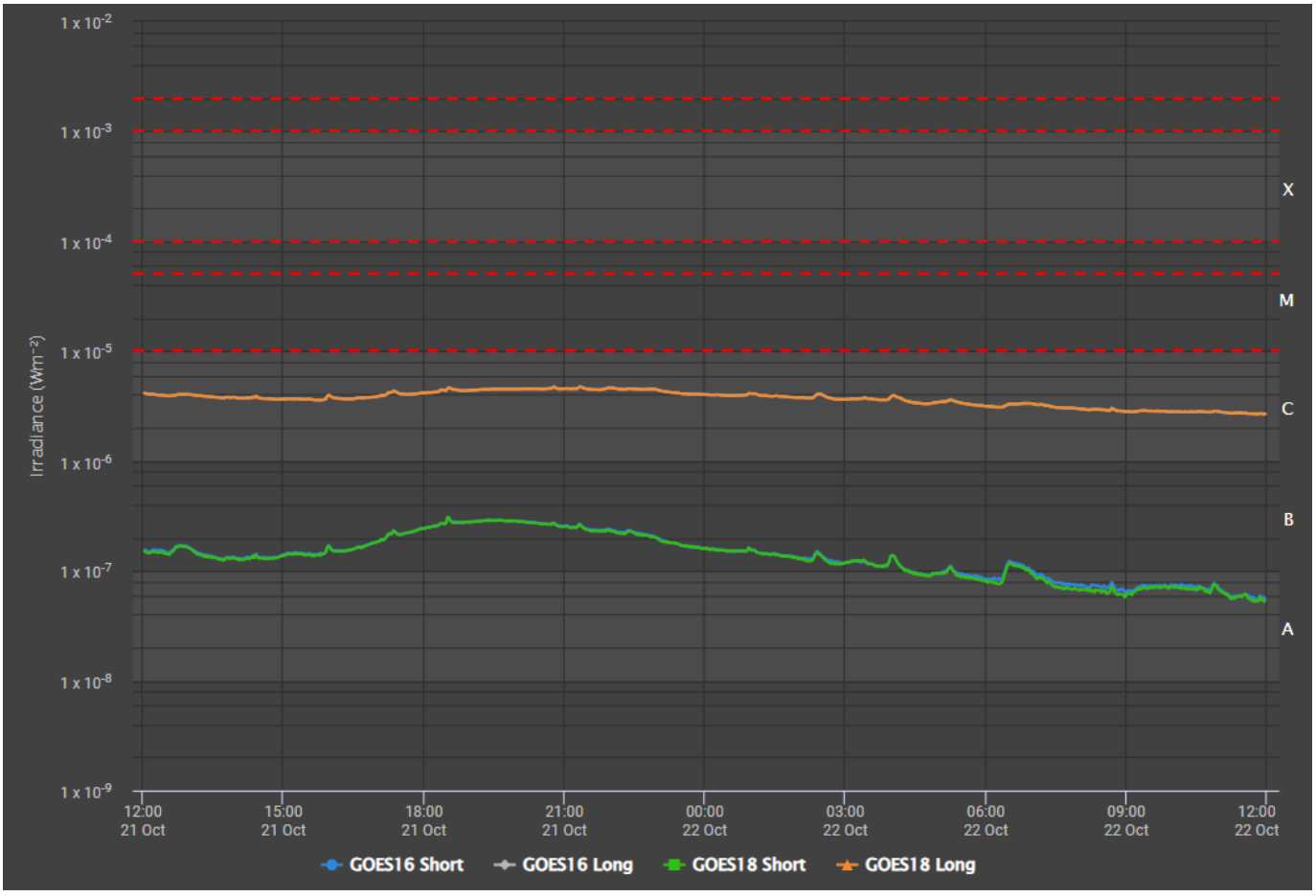
It remains the case that activity is expected to increase in the coming days, as recurrence, recent CME activity, and far-side sounding data all suggest the return of several active regions that were present on the disc earlier in October. Bright looping is evident near the eastern limb in SDO AIA171 imagery, with recurrence suggesting the return of Ex-AR3842, previous source of several strong flares (including SC25's peak X9.0 flare on 03 October) by midweek UTC. As such, activity should increase to become generally Moderate, with M-class flares Likely, and an increased, but still Slight Chance of isolated X-class flares, dependent on the size and configuration of the regions once they become apparent in EUV imagery.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	No	30	40	60	60
Very Active	R3-R5 (X Class)	No	5	10	10	10

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

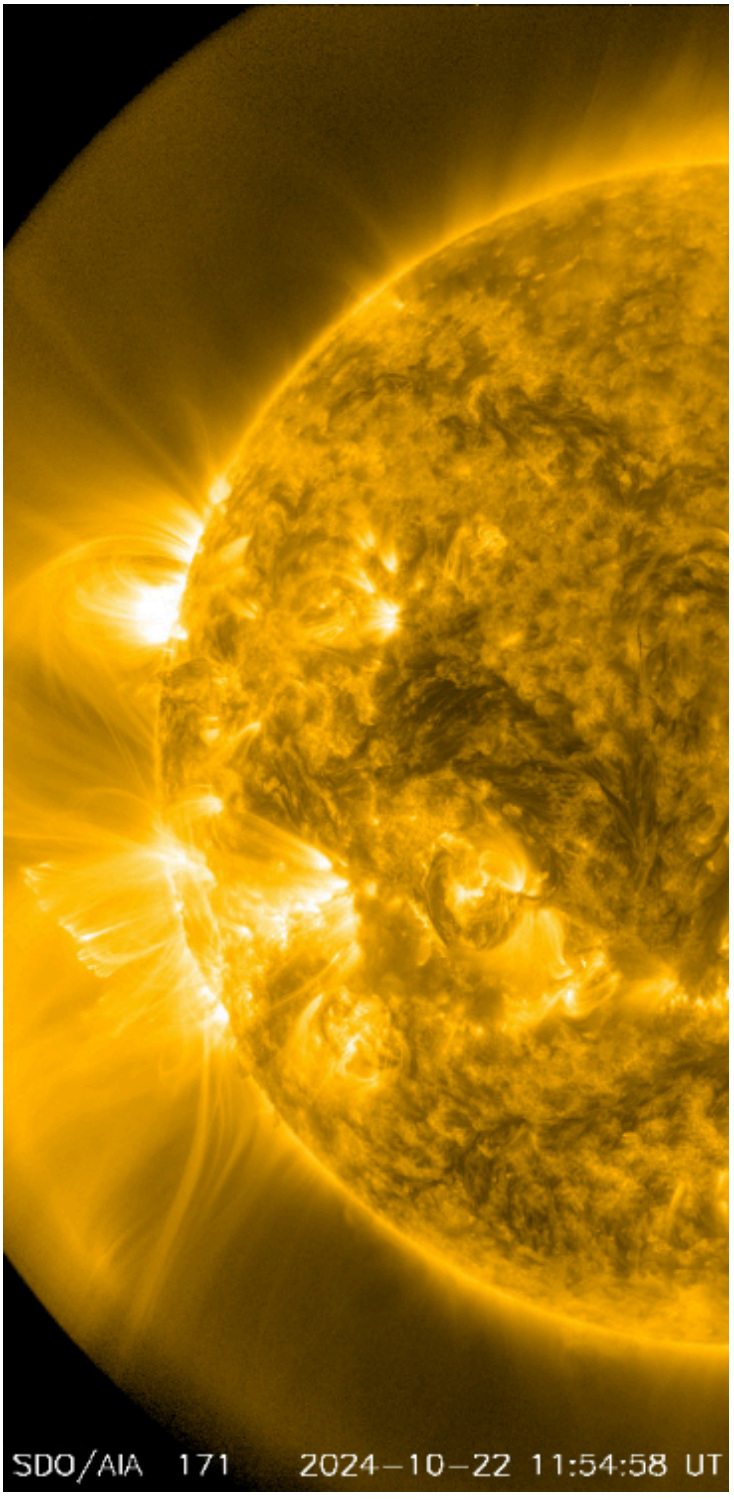
© Crown Copyright 2024. All Rights Reserved.

Figure 3: 24 hour X-ray trace



© Crown Copyright 2024. All Rights Reserved.

Figure 4: SDO 171 imagery showing returning bright regions around the limb.



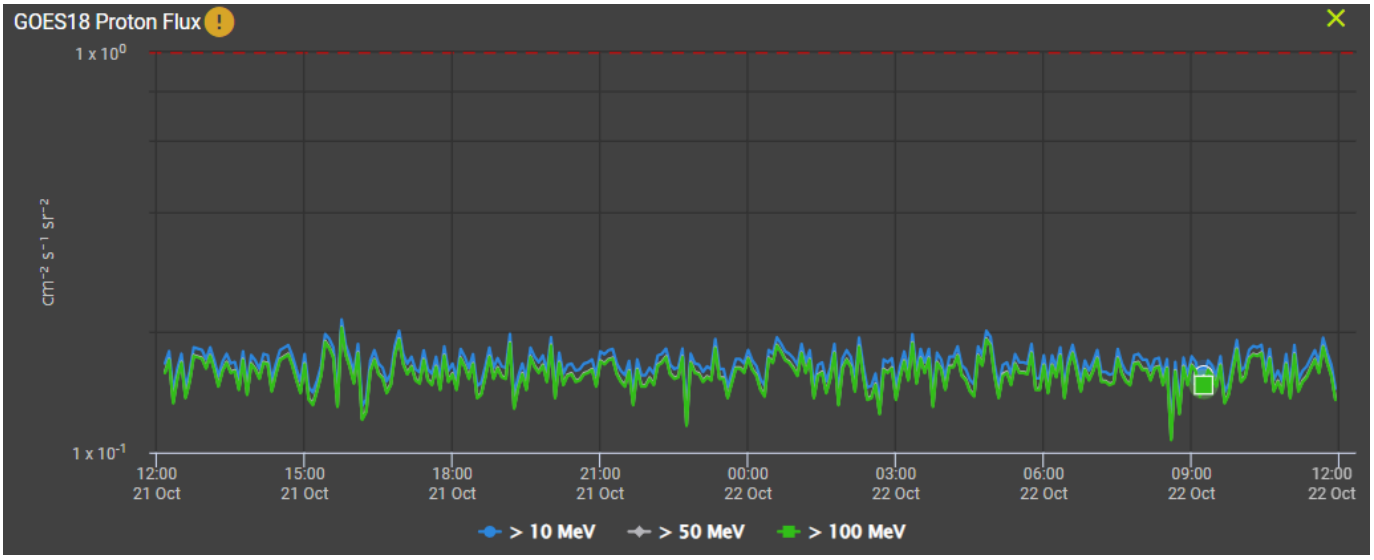
© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is expected to remain at Background levels. There is only a very Slight Chance of a significant enhancement, with limited flare activity observed from the regions currently on the visible disc, and any more potent east limb arrivals a long way from more threatening solar longitudes.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 5: Proton trace past 24 hours.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

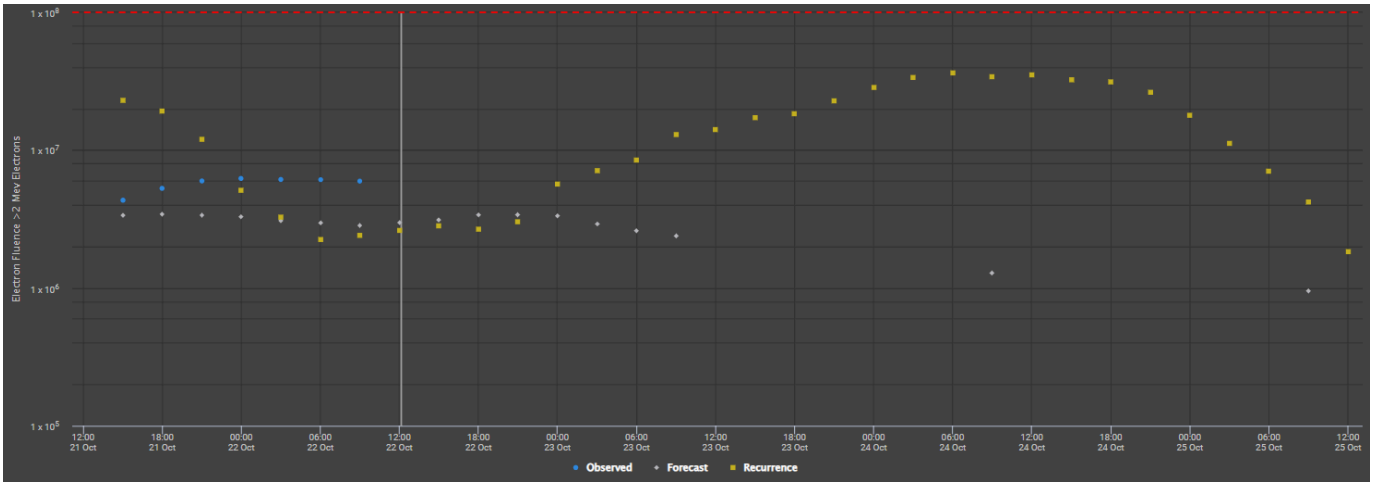
High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 has mainly been at Normal Background levels, with only brief incursions above the Moderate threshold at diurnal peak. The expected onset of fast winds from central disc CH82/+ on day 1 (Tuesday 22 October) is expected to suppress flux values at GEO for a time, but with an eventual chance of rising back towards flux peaks of Moderate, or perhaps High levels later in the UTC working week.

The associated 24-hour fluence is currently expected to remain below Active throughout the period, with MOSWOC REFM thought to be providing good guidance.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	5	10
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 6: MOSWOC REFM fluence forecast/observations/recurrence.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.